

16. PHYSICAL STUDY OF PLANETS AND SATELLITES
(ETUDE PHYSIQUE DES PLANETES ET DES SATELLITES)

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I. INTRODUCTION

During past three years from 1982 to 1984 we saw the further progress in the planets and satellites research by the space and ground-based technique, in the analysis and interpretation of the observational data. In spite of some decrease of the activity in the planetary spacecrafts launches during this period (except of two Soviet missions to Venus) many important scientific results were obtained from the continued reduction and analysis of the measurements which were performed by Mariner 10 (Mercury), Pioneer Venus, Venera 13 and 14, Viking (Mars), Pioneer 10 and 11, and Voyager 1 and 2.

It is impossible to review here even the main results of the planetary studies because the number and volumes of recent publications are too great and the simple listing of them would request of many pages.

The summaries of a number of most important papers were published regularly in the Journal MOON AND PLANETS, which is named now EARTH, MOON, AND PLANETS. Each planetary scientist can find the valuable collection of papers in ICARUS (International Journal of Solar System studies) which is published monthly and consists of four volumes per year.

Most of Soviet planetary papers are published in Russian ASTRONOMICHESKIY VESTNIK, which is translated into English as SOLAR SYSTEM RESEARCH, and the results of planetary space studies are published in special issues of the Journal KOSMICHESKIE ISSLEDOVANIA (SPACE RESEARCH).

Many interesting and useful books have appeared during past three years. General problems of the planetary physics were considered in "Moon and planets" by W.K.Hartmann (Belmont, California, 1983) and in Russian "Introduction to the Physics of the Planets" by Yu.V.Alexandrov (Kiev, 1982), and "Key problems of the studies of the Solar System Planets" by K.Ya.Kondratiev and N.I.Moskalenko (Moscow, 1983). Best planetary photographs are collected in "The Cambridge Photographic Atlas of the Planets" by G.A.Briggs and F.W.Taylor (Cambridge Univ.Press, 1983). The physics of the planetary interiors have discussed in "Inner structure of the Earth and Planets" by V.N.Zharkov ("Nauka", Moscow, 1983).

II. THE STUDY OF THE TERRESTRIAL PLANETS

Two Soviet automatic space probes Venera I5 and I6 launched in June 1983 were placed into elliptic polar orbits around Venus. By means of the board side-view radar system the images of Venus surface were obtained simultaneously with the measurements of the altitude differences by radioaltimeter. Very informative radar maps of the Venus surface relief were constructed from these measurements for the north hemisphere of Venus from the latitude 30°N to pole with a resolution about 1-1.5 km. It was the first so detailed study of the Venus surface and many unusual relief formations (the impact and volcanic craters, mountain chains, ring-shaped ridges, lava flows etc.) were discovered. The joint experiment of the USSR and GDR scientists for infrared Fourier spectrometry aboard of Venera has confirmed the presence of significant altitudinal variations of the clouds upper boundary on Venus. The variations of the minor atmospheric components abundances and of the thermal flux have been analysed in detail from the measurements of the spectrum at the wavelengths 6 to 36 μm . The main results of these experiments were published preliminary in special issue of "Pisma v Astronomicheskij Zhurnal" (SOVIET AJ LETTERS) 10, No II, 1984.

The beautifully illustrated review of the Venus study results from Pioneer Venus was published by R.O.Fimmel, L.Colin, and E.Burgess (NASA, 1983) with a supplement about the Soviet studies of Venus. From the data of Venus probes the models of the vertical structure of the mesosphere and lower thermosphere were developed by A.Seiff and D.B.Kirk (ICARUS, 49, 49-70, 1982). The comprehensive review of the spectral measurements of scattered solar radiation within the Venus atmosphere from Venera II and I2 descent probes has been published by V.I.Moroz et al. in ICARUS 53, 509-537, 1983.

Two symposia "Venus atmosphere" and "Planetology of Venus, Mars, and satellites of outer planets" were held in Graz, Austria in June 1984.

The series of papers on the results obtained from Venera I3 and I4 were published in "Pis'ma v Astron.Zhurnal" 8, No 7, 1982 and in "Kosmicheskie Issledovania" 21, No 2 and 3, 1983.

Most of modern knowledges about Venus is reviewed in the book "Venus" (Eds. D.M.Hunten, L.Colin, T.M.Donahue, and V.I.Moroz; Univ. Arizona Press, 1983).

Three monographs were published in Russian: "Photochemistry of the atmospheres of Mars and Venus" by V.A.Krasnopol'skij ("Nauka", Moscow, 1982), "Chemistry of the atmosphere and surface of Venus" by V.P.Volkov, and "Cryolithosphere of Mars" by R.O.Kuzmin ("Nauka", Moscow, 1983).

Double issue of ICARUS (50, No 2-3, 1982) was given up to the papers about the Martian geology and climate changes, presented on the workshop that was held in NASA Ames Research Center in February 1981.

III. THE OUTER PLANETS

There was continued the publication of the results of ultraviolet spectrophotometry of Jupiter, Saturn, Uranus, and Neptune from satellite IUE. Very impressive results were obtained from the observations of the radioemission of major planets at the centimeter wavelengths with high angular resolution (to 1.5 arcsec) using VLA (I.de Pater et al., ICARUS 50, 88-102; 51, 25-38, 1982; Adv.Space Res. 3, 39-41, 1983 ets.)

The book "Physics of the Jovian magnetosphere (Ed. by A.J.Desler, Cambridge Univ.Press, 1983) has presented a collection of the review papers about the different topics of the study of magnetic field, charged particles, plasma waves, and electromagnetic emissions from Pioneer and Voyager.

The detailed analysis of polarimetric and photometric measurements from Pioneer for Jupiter and Saturn was carried out by M.G. Tomasko et al. (ICARUS 58,1-34, and 35-73, 1984).

The papers presented at the meeting "Saturn" (Tucson, Arizona, May 1982) were collected in two special issues of ICARUS (53, No 2, 1983, and 54, No2, 1983) and main reviews of different topics of Saturn's physical properties and the nature of Titan's atmosphere were compiled in the chapters of the book "Saturn" (Eds. T.Gehrels and M.Matthews, Univ.Arizona Press, 1984).

Many results of the Saturn study from Voyager 2 were described in special issue of SCIENCE 215 No 4532, 1982 and in the book "Voyages to Saturn" by D.Morrison (NASA, 1982).

The reviews of modern state of our knowledges about Uranus which has been discussed at the IAU Colloquium No60 in Bath (England) in April 1981 are found in the book "Uranus, and the outer planets" (Ed.G.Hunt, Cambridge Univ.Prss, 1982). More recent studies of Uranus and Neptune have been presented in Proceedings of a workshop held in Pasadena, California (Ed. J.T.Bergdtralh, JPL, February 1984).

The collected book "The physics of planetary atmospheres" with papers about photometry and spectrophotometry of Jupiter and Saturn was published in Russian (Kiev, 1982).

Some problems of the outer planets research have been discussed at the COSPAR Symposium on the Giant Planets and their Satellites in Ottawa (May 1982), on scientific sessions in Patras, Greece (August 1982), and during the scientific session at the Meeting of WGPSN in Tbilisi, USSR (April 1984).

IV. PLANETARY SATELLITES

Most of problems of the physics, chemistry and geology of the Moon are considered at annual Lunar and Planetary Conferences in Houston, Texas. The Polarimetric Atlas of the Moon has been prepared and published by V.P.Dzhapiashvili and A.N.Korol' (Tbilisi, 1982).

The numerical data for the model of the vertical structure of Titan's atmosphere from the Voyager I radio occultation experiment have given in the paper of G.F.Lindal et al. in ICARUS 53, 348-363, 1983.

The presence of the water ice on the surface of Miranda was detected by R.H.Brown and R.N.Clark. From the study of the near-infrared spectrum of Triton D.P.Cruikshank et al. have discovered the absorption band at 2.16 μm which is tentatively identified as the density-induced band of liquid nitrogen. These communications as well as many other papers were presented at the IAU Colloquium No 77 "Natural Satellites" held at Cornell University in July 1983 and published in special issue of ICARUS 58, No2, 1984.

The problems of the structure and dynamics of the rings around Jupiter, Saturn, and Uranus were a subject of the IAU Colloquium No 75 (Toulouse, France, August-September 1982) and described in the book "Planetary Rings" (Eds. R.Greenberg and A.Brahic, Univ. Arizona Press, 1984).

V. COMMISSION BUSINESS

The members of the Organizing Committee have discussed the proposal on the preparation of the International Reference Book - Review "Physical Characteristics of the Planets". The preliminary project of this book with the invitations to participate as the authors of any parts of book and the chapters editors was distributed between the Commission I6 members.

The ephemeris of the future mutual events in the Jovian satellites system in 1985-1986 were computed for several observatories by K.Aksnes.

V.G.Teifel'

President of Commission